Multiple choice questions - Matrices and linear transformations

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Question 1 $\det \begin{pmatrix} 4 & 3 \\ 2 & 5 \end{pmatrix} =$

- ◯ **A.** 14
- ◯ **B.** 26
- ◯ **C.** -14
- ◯ **D.** 7

Question 2 If $\mathbf{P}$ is applied first, then $\mathbf{Q}$, the combined matrix is:

- ◯ **A.** $\mathbf{PQ}$
- ◯ **B.** $\mathbf{QP}$
- ◯ **C.** $\mathbf{P} + \mathbf{Q}$
- ◯ **D.** $\mathbf{P}^{-1}\mathbf{Q}$

Question 3 A shear $\begin{pmatrix} 1 & 3 \\ 0 & 1 \end{pmatrix}$ has area scale factor:

- ◯ **A.** 3
- ◯ **B.** 1
- ◯ **C.** 4
- ◯ **D.** 0

Question 4 The matrix $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ represents:

- ◯ **A.** rotation 90° clockwise
- ◯ **B.** reflection in $y = x$
- ◯ **C.** rotation 90° anticlockwise
- ◯ **D.** rotation 180°

Question 5 If $\det \mathbf{M} = -4$, the area scale factor is:

- ◯ **A.** -4
- ◯ **B.** 4
- ◯ **C.** $\frac{1}{4}$
- ◯ **D.** 0

Question 6 Which is always true for 2×2 matrices?

- ◯ **A.** $\mathbf{AB} = \mathbf{BA}$
- ◯ **B.** $\det(\mathbf{AB}) = \det \mathbf{A} \det \mathbf{B}$
- ◯ **C.** $\det(\mathbf{A} + \mathbf{B}) = \det \mathbf{A} + \det \mathbf{B}$
- ◯ **D.** $\det(2\mathbf{A}) = 2 \det \mathbf{A}$

Question 7 The eigenvalues of $\begin{pmatrix} 2 & 0 \\ 0 & 5 \end{pmatrix}$ are:

- ◯ **A.** $2, 5$
- ◯ **B.** 7
- ◯ **C.** 10
- ◯ **D.** $0, 7$

Question 8

- ◯ **A.** 1
- ◯ **B.** 5
- ◯ **C.** 6
- ◯ **D.** 0

Question 9 Reflection in the line $y = x$ has matrix:

- ◯ **A.** $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$
- ◯ **B.** $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$
- ◯ **C.** $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$
- ◯ **D.** $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$

Question 10 The matrix $\begin{pmatrix} 2 & 4 \\ 1 & 2 \end{pmatrix}$ is:

- ◯ **A.** invertible
- ◯ **B.** singular
- ◯ **C.** a rotation
- ◯ **D.** the identity

Answer grid - Matrices and linear transformations

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Question	Answer	Explanation
1	**A**	$20 - 6 = 14$.
2	**B**	The first transformation is nearest the vector.
3	**B**	$\det = 1$.
4	**C**	$\mathbf{i} \mapsto \mathbf{j}$ and $\mathbf{j} \mapsto -\mathbf{i}$.
5	**B**	Area scale factor is $\lvert \det \mathbf{M} \rvert$; the negative sign indicates reflection.
6	**B**	$\det(2\mathbf{A}) = 4 \det \mathbf{A}$ for 2×2.
7	**A**	Diagonal matrix.
8	**C**	Product of the diagonal entries.
9	**B**	$\mathbf{i} \mapsto \mathbf{j}$, $\mathbf{j} \mapsto \mathbf{i}$.
10	**B**	$\det = 4 - 4 = 0$.